




GREEN ROOFS
FOR HEALTHY CITIES
www.greenroofs.org



How Your Community Will Benefit From Adopting Green Roof Policy

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For every dollar spent on green roofs \$0.75-0.85 goes towards local job creation in:

- Design
- Consulting
- Manufacturing
- Construction
- Maintenance



Green roofs have the ability to decrease the volume and increase the quality of stormwater runoff and slow down the velocity of a typical “first flush”

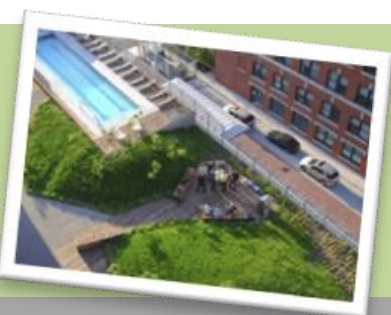
- Green roofs are the perfect technology for North American cities because they provide *more* unmatched dollar-for-dollar public and private benefits than any other grey or green infrastructure available today.
- Numerous government agencies and municipalities have recognized green roof benefits and incorporated supportive policies into their green infrastructure procurement and green building programs.
- Green roofs typically occupy unused urban spaces – rooftops which may comprise anywhere from six to thirty-five percent of your land area.
- Green roofs can be incorporated into new construction and retrofit projects.
- Greening this “fifth facade” of a building introduces countless economic, environmental and social opportunities to your community.
- Green roof benefits are both public and private in nature.

Green roofs require more investment upfront than typical roofs but deliver multiple public and private benefits.

Typical Public and Private Benefits of Green Roofs

PUBLIC	PRIVATE
Creates local jobs	Aesthetic improvement
Improves stormwater management - quality and quantity	Energy savings
Improves air quality	Increases property value
Increases biodiversity	Increases employee productivity
Decreases municipal infrastructure costs	Reduces employee absenteeism
Increases tax revenues	Increases roof membrane durability
Reduces the urban heat island effect and peak load energy demand	Improves solar panel efficiency
Improves community health and well-being	Meets stormwater and green space regulations
Facilitates new recreational opportunities	Improves marketability
Reduces greenhouse gas emissions	Urban agriculture revenue potential

For more benefit information see ‘About Green Roofs’ at www.greenroofs.org.



“Rooftop gardening is an attractive and energy-saving alternative to a conventional rooftop. Rooftop gardens can keep buildings cooler, save energy, extend the useful life of the roof, and add beauty and useable space.”

- Richard M. Daley (Former Chicago Mayor)

Green Infrastructure Complements Traditional Grey Infrastructure

Green infrastructure includes a variety of vegetative technologies such as:

- Greenways
- Restored and constructed wetlands
- Urban forests
- Rain gardens
- Permeable and pervious paving systems
- Community gardens
- Green roofs
- Green walls
- Bioswales

Green infrastructure can complement traditional grey infrastructure by retaining stormwater, shading surfaces such as asphalt and membranes, providing wind breaks, and reducing energy demand. Green infrastructure can also help restore degraded habitat, reconnect people to nature, provide food and recreational opportunities and improve the overall urban aesthetic. Green infrastructure often costs less to install and maintain when compared to grey forms of infrastructure such as centralized water storage tunnels and sewers. Green infrastructure can generate local green jobs and even foster greater community cohesiveness.



According to a 2010 study titled "The Monetary Value of the Soft Benefits of Green Roofs" by Dr. Ray Tomalty et al. homes adjacent to public parks have about a 20% higher property values than similar homes distant from parks. The study estimates that the property value will increase by approximately 11%, depending on the size and access to a green roof. Having a view of a green roof with trees is estimated to increase property values by as much as 9%. Higher property values translate into higher tax revenues.

(http://www.greenroofs.org/resources/Monetary_Value_of_Soft_Benefits_of_Green_Roofs.pdf)

The American Society of Civil Engineers (ASCE) is committed to protecting the health, safety, and welfare of the public, and as such, is equally committed to improving the nation's public infrastructure. To achieve that goal, the 2013 "Report Card for America's Infrastructure" depicts the condition and performance of the nation's infrastructure in the familiar form of a school report card. The ACSE gave wastewater and stormwater infrastructure a letter grade of D for 2013. They estimate the capital investment needed for the nation's wastewater and stormwater systems to total \$298 billion over the next twenty years. Pipes represent three quarters of the total capital need. Fixing and expanding the pipes will address sanitary sewer overflows, combined sewer overflows, and other pipe-related issues. Green infrastructure complements grey infrastructure by naturally managing stormwater, reducing flooding risk, erosion, and improving water quality.



Green walls are an emerging form of green infrastructure with benefits such as:

- Air Quality Improvements (Indoor/Outdoor)
- Aesthetic Improvement
- Urban Heat Island Reduction
- Job Creation
- Noise Reduction
- Health and Well-being



Green roofs improve the efficiency of solar panels, cool cities and reduce peak energy demand

“The green approach could not work without a good traditional foundation. Pipes and sewers are the backbone of our system, but the green helps the grey do a better job.”

- Joanne Dahme (General Manager Public Affairs - Philadelphia Water Department)

About Green Roofs



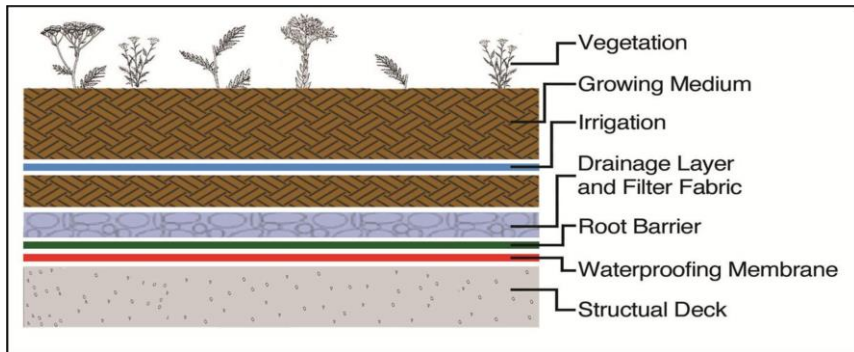
The Green Roof Industry has grown 10 fold in North America since 2003

Green Roofs for Healthy Cities estimates that over 20 million square feet of green roofs were installed in North America in 2012. Globally, green roofs are a multi-billion dollar industry.



Green roofs can be designed to achieve different objectives, such as maximizing stormwater retention, improving air quality, supporting biodiversity or providing recreational green space.

Modern green roofs emerged in Germany in the 1960s but vegetation has been used as roofing material for thousands of years. A green roof, also known as a vegetated roof, rooftop garden, living roof, or eco-roof, is an extension of an existing roof which involves high quality waterproofing membrane, root repellent system, drainage system, filter cloth, lightweight growing medium (soil), irrigation system, and plants. Green roof implementation involves the creation of "contained" green space on top of a human-made structure. This green space could be below, at, or above grade, but in all cases the plants are not planted in the "ground".



Two Main Types of Green Roof Systems

- **Modular (see right):** drainage layers, filter cloth, growing media and plants are prepared in movable, sometimes interlocking grids, and mats.
- **Loose-laid/ built-up:** each component of the system is installed separately and they are layered on top of each other.



Many different green roof products can be used to respond to specific design opportunities and constraints. While all green roof systems contain the same basic components, the products and installation methods used will vary to meet design requirements, project constraints, and benefit objectives, making each green roof unique. There are three basic categories of green roof infrastructure: extensive, semi-intensive, and intensive. The characteristics of each are described below.

General Characteristics of Three Main Green Roof Types

	EXTENSIVE	SEMI-INTENSIVE	INTENSIVE
Growing Medium Depth	6" or less	25% of the green roof area above or below 6"	More than 6"
Accessibility	Often inaccessible	May be partially accessible	Usually accessible
Fully Saturated Weight	10–35 lb. / sq. ft.	35–50 lb. / sq. ft.	35–300 lb. / sq. ft.
Plant Diversity	Low	Greater	Greatest
Cost	Lowest	Varies	Highest
Maintenance	Minimal	Varies	Varies, but is generally high

Green Roofs are a Proven Technology

The GSA and the EPA Recommend and Utilize Green Roofs

The Environmental Protection Agency (EPA) recognizes green roofs as an innovative Best Management Practice. The EPA has stated that the large-scale implementation of green roofs will reduce the volume of stormwater entering local waterways resulting in less in-stream scouring, lower water temperatures and better water quality. EPA related initiatives:

Green Infrastructure Action Plan

- Aims to increase national and local capacity to evaluate the role of green infrastructure and the benefits that it can provide.

Clean Water Act

- Mandated by Congress and enforced by the EPA.
- Implemented by municipalities.
- Main goals are to: reduce stormwater quantity; increase stormwater quality; increase stormwater delay.

National Pollutant Discharge Elimination System (NPDES) permit program

- EPA developed and implemented this program based on the requirements of the *Clean Water Act*.
- Controls water pollution by regulating point sources that discharge pollutants into US waterways.
- Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), from which it is often discharged untreated into local water bodies. Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges.

Urban Heat Island Initiative

- The annual mean air temperature of a city with 1 million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C).
- Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.
- Every 1.08°F increase in air temperature can add 1.5 to 2% to peak energy demand for cooling.
- Green roofs, green walls and trees cool cities through shading and evapotranspiration of water.

The GSA routinely installs green roofs and currently maintains more than 24 green roofs in 13 cities.



Highlights from 2011 Congressional report titled: “Benefits and Challenges of Green Roofs on Public and Commercial Buildings” include:

- The average life expectancy of a waterproof membrane under a green roof is about 40 years, versus 17 for a conventional roof. Numerous membranes under green roofs have outlived that time period having been in place since the 1930s.
- Green roofs reduce costs by producing savings related to stormwater regulations and reduced stormwater runoff impacts, notably combined sewer overflows, due to their water absorption properties. Nationally, extensive green roofs provide \$0.084 per square foot in annual savings in stormwater based on current regulations.
- Green roofs provide year-round energy savings due to their cooling, shading, and insulating abilities.
- Green roofs reduce the urban heat island effect, peak load demands and can reduce heat-related illness and mortality in cities.
- Nationally, peak load reduction is conservatively estimated to be worth \$0.23 per square foot per year.

Federal Funding Sources for Green Infrastructure Incentives

- Clean Water State Revolving Funds
- Section 319 Nonpoint Source Management Grant
- Watershed Specific Federal Grant
- National Fish and Wildlife Foundation (NFWF) Grant
- U.S. Environmental Protection Agency Urban Water Program
- FEMA flood management grants
- US Department of Agriculture grant and cost share for urban agriculture projects
- Other federal grants from National Oceanic and Atmospheric Administration, US Geological Survey, Fish and Wildlife of the US Department of Interior

“Green roofs can be effectively used to reduce stormwater runoff from commercial, industrial, and residential buildings. In contrast to traditional asphalt or metal roofing, green roofs absorb, store, and later evapotranspire initial precipitation, thereby acting as a stormwater management system and reducing overall peak flow discharge to a storm sewer system.”



- Environmental Protection Agency (EPA)



With policy support, green roofs can become a sound investment for “big box” stores

A three-year study managed by Walmart proved that green roofs provide a payback on investment in less than 20 years and should be considered as a viable option to replace reflective white roofs.

In three of the nine regions analyzed it was determined that a return on investment was achieved in as little as 0-3 years. This was mainly due to regional policies that support green roof installation.



There are over 600 trained and accredited Green Roof Professionals in North America

How Municipalities Develop a Local Green Roof Industry

Due to their many public benefits municipal leaders are providing regulatory policies that require green roofs on new buildings, and/or financial incentives that reduce the higher initial costs for new and existing building owners. A major congressional study by ARUP Engineering for the GSA found that extensive green roofs, over a 50 year period, deliver an average of *over* \$38/square foot of public benefits, nationally.

Tools Used To Support Local Green Roof Installation

Policies

- Green Building Standards
- Green Landscape Standards
- Fast Track Permitting
- Green Space Allocation
- Education and Awareness
- Procurement
- Support Local Research

Financial Incentives

- Direct Incentives
- Density Bonuses
- Direct Investment/Grants
- Indirect Incentives
- Tax Credits/Rebates
- Low Interest Loans
- Energy Efficiency Incentives
- Stormwater Fee Rebates

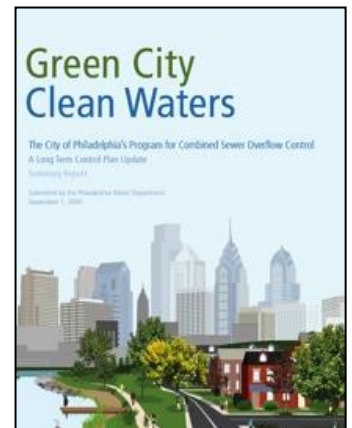
Philadelphia’s Green City, Clean Waters

Green City, Clean Waters is Philadelphia's 25-year plan to protect and enhance its watersheds by managing stormwater with innovative green infrastructure.

The Philadelphia Water Department (PWD) developed *Green City, Clean Waters* to provide a clear pathway to a sustainable future while strengthening the utility, broadening its mission, and complying with environmental laws and regulations.

PWD developed this program when they were faced with developing a viable long-term stormwater management plan to meet their obligations under the EPA’s *Clean Water Act*. During this process the PWD saw an opportunity to reinsert nature into what had become an unnatural equation.

Instead of opting to expand the traditional grey infrastructure and build more pipes and tanks to treat wastewater, they chose to invest in green infrastructure. A cost benefit analysis showed that it would cost \$2.4 billion over 25 years for the green infrastructure approach as opposed to \$8 billion for grey infrastructure. The City of Philadelphia created a Green Roof Tax Credit program that provides up to 25% of all costs incurred to construct a green roof to a maximum of \$100,000 per project.



“Elected officials and politicians across America, not only in progressive cities, need to embrace green walls and roofs as best management practices in government approvals process. Approval authorities should consider the inclusion of these amenities as alternative compliance for greening requirements and as a way to reduce stormwater runoff.”

- Lisa R. Goodman (Minneapolis City Council Member)

Municipal Green Roof Policy Initiatives at a Glance

Chicago, IL: Green Roof Permit Program

- Many incentives and an expedited building permit program.

Devens, MA: Vegetated (Green) Roof Construction Standard

- Green roofs and green walls are a requirement for new development under this construction standard.

Grand Rapids, MI: Greenspace Provision

- Green roofs and green walls qualify under this provision.

Milwaukee, WI: Regional Green Roof Initiative

- \$5 for each square foot of approved green roof.

Minneapolis, MN: Stormwater Credit Program

- Up to 100% discount on stormwater utility fees for properties that manage their stormwater quality and quantity. Green roofs are listed as an applicable tool.

Nashville, TN: Green Roof Credit

- A \$10 rebate for each square foot of green roof.

New York, NY: Green Roof Tax Abatement

- A \$5.23 rebate for each square foot of green roof up to \$200,000 per project.

Philadelphia, PA: Green Roof Tax Credit

- A credit of up to 25% of all costs incurred to construct a green roof with a maximum of \$100,000 per project

Portland, OR: Floor Area Ratio (FAR) Bonus

- 10-30% Green Roof = 1 extra square foot of floor area.
- 30-60% Green Roof = 2 extra square feet of floor area.
- 60%+ Green Roof = 3 extra square feet of floor area.

Syracuse, NY: Green Improvement Fund

- Funding available to projects utilizing green infrastructure solutions and elements. Nearly \$4 million towards 37 projects so far, many include green roofs.

Toronto, ON: Green Roof Bylaw / Procurement

- Green roofs are required on all new commercial, institutional, multi-unit residential developments and new buildings not affected by the bylaw. Incentives of \$7 per square foot. Over 2.5 million square feet permitted.
- Green roofs required on public buildings.

Seattle, WA: Green Factor Program

- Green roofs and green walls qualify under this program which sets minimum green infrastructure thresholds for new and redevelopment.

Washington, DC: Green Roof Rebate Program

- Base funding between \$7 and \$10 per square foot of green roof depending on the project's sewage shed area.



Green roofs on hospitals speed up patient recovery



Green roofs can provide communities with additional park space

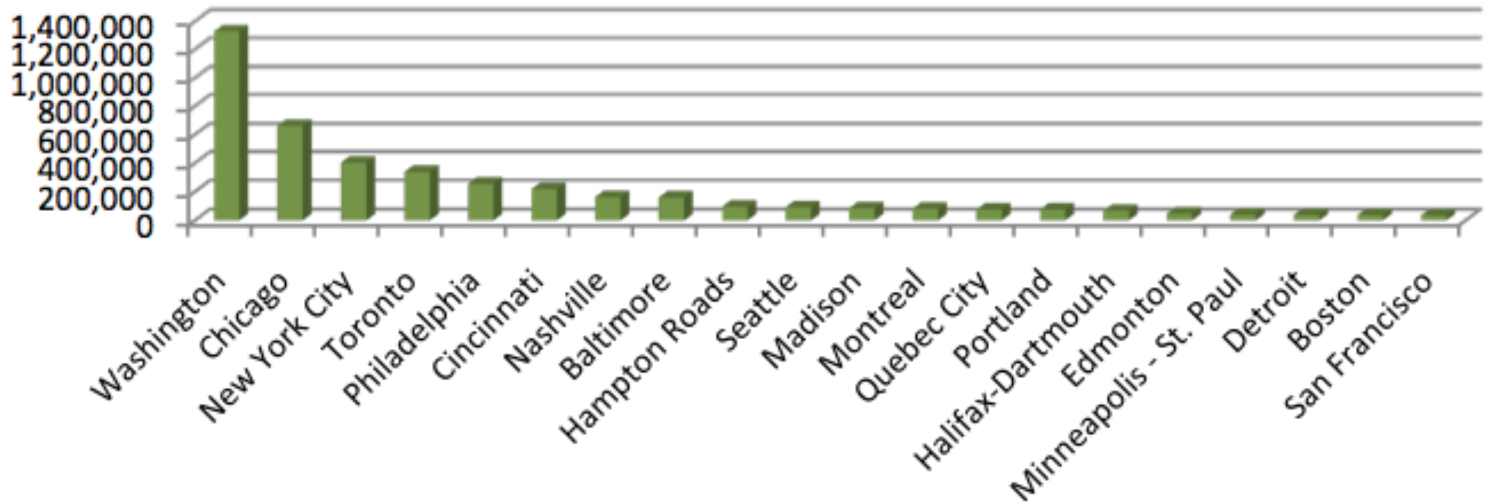


Green roofs increase community resilience and jobs by facilitating rooftop agriculture

“Green roof incentives deliver taxpayer value by leveraging private roofing investments; exploiting wasted roof space; eliminating negative black roof impacts, and replacing them with infrastructure that manages stormwater, improves air quality, saves energy, reduces the urban heat island, supports biodiversity, creates beauty, local jobs and last decades longer. Few if any public infrastructure investments yield so many public and private benefits.”

- Steven Peck, GRP, Hon. ASLA, Founder and President, Green Roofs for Healthy Cities

Top 20 North American Metro Regions - Green Roofs Installed in 2012 by GRHC Corporate Members in Square Feet



Green Roofs for Healthy Cities is available to help you develop your local Green Roof industry

- Market and Policy Development Symposiums
- Green Roof Task Force development
- City wide cost-benefit analysis of policy options
- Green Infrastructure Design Charettes
- Customized policy training and professional education

**For more information please contact:
Blaine Stand: policy@greenroofs.org;
416-971-4494 ext. 223**

Green Roofs for Healthy Cities—North America Inc. is a not-for-profit industry association working to promote the green roof and wall industry throughout North America. Green Roofs for Healthy Cities is registered as a not-for-profit 501(c)(6). In 2007 GRHC established the Green Infrastructure Foundation, as a charitable 501 (c)(3), to promote green infrastructure education. See www.citiesalive.org for annual conference information and www.livingarchitecturemonitor.com to read our magazine.

